EXAMINING BIVARIATE ITEM-CRITERION ASSOCIATIONS: A METHOD OF EXPLORING PERSONALITY CORRELATES OF JOB-RELATED BEHAVIOR*

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SUMMARY

Personality may be related to job outcomes, including military attrition. Typical approaches to studying such associations either employ predetermined multi-item scales designed to measure selected theoretical constructs or apply procedures such as stepwise regression or stepwise discriminant function analysis to develop predictive composites based on responses to individual items in a personality inventory. Limitations of current personality theory permit the former approach to overlook important personality correlates of a criterion. The latter approach selects relatively uncorrelated items, and, therefore, is ill-suited for identifying a core of item content defining key personality constructs. Identifying items with reliable bivariate associations to the criterion may be a useful alternative to these common methods of identifying personality correlates of job outcomes.

This study tested three hypotheses related to the study of bivariate item-criterion correlations: (1) Items would show reliable differences in associations to criteria. (2) Analysis of interitem correlations for items selected by the proposed approach would define meaningful personality constructs. (3) Item composites derived from the proposed approach would produce stronger correlations to the behavioral criterion when applied in a new sample than would a composite formed by stepwise analysis.

The hypotheses were tested by relating personality to behavioral attrition from Marine Corps basic training in two samples comprised of 2,461 and 325 recruits, respectively. The larger sample was randomly divided into thirds. Risk ratios, defined as the probability of attrition given a "no" response divided by the probability of attrition given a "yes" response, were computed in each third. These risk ratios were used to identify items which consistently had high or low risk ratios for further analyses relating personality to attrition. Results were:

(a) Risk ratio differences between items were stable across the three subsamples ($r > .48$).

(b) Eighteen items with risk ratios greater than 1.25 or less than .80 in each subsample were identified as having risk ratios which consistently deviated from 1.00. These 18 items were substantially more correlated than 18 items selected by stepwise discriminant function analysis with attrition

as the criterion and defined two factors similar to the concepts of depression and will-to-achieve described in current personality measurement models.

(c) The 18 risk ratio items formed a composite that predicted attrition in the second recruit sample better than a comparable 18 item composite based on stepwise discriminant function analysis (r = .26 versus .17) or the combination of two dimensions defined by factor analysis (r = .26 versus Multiple R = .20).

The three hypotheses were confirmed, thereby indicating that studying bivariate item-criterion associations is an effective approach to identifying personality-job outcome associations. This approach can provide a set of reliable empirical observations as a basis for personality theory development and refinement, including better specification of relationships between personality and job outcomes.

INTRODUCTION

Personality influences success in the work place (Hogan, Hogan & Busch, 1984; Gough, 1985), but the associations involved have not been fully delineated. This paper provides a rationale for investigating bivariate item-criterion correlations to better understand those associations. The benefits of this approach are illustrated by predicting attrition from military basic training with items from a standardized personality questionnaire.

Bivariate item-criterion associations merit consideration as a means of overcoming limitations of the most widely used methods of investigating personality-job outcome associations. The use of multi-item scales selected on theoretical grounds has been recommended for such investigations (Nunnally, 1978, pp. 265-270). This approach will be most effective when theory clearly specifies the personality variables to be considered and their relationships to the job outcome of interest. At present, personality theory does not satisfy the first requirement. Different theoretical orientations represented by standardized personality inventories suggest anywhere from three to five independent general dimensions (Eysenck & Eysenck, 1985; Costa & McCrae, 1985) to 43 correlated specific dimensions (Hogan, 1984) with intermediate stops at six (Hogan, 1984), eight (Comrey, 1970), 16 (Cattell, Eber & Tatsuoka, 1970) and 20 (Jackson, 1984) dimensions. The confusion engendered by the range of choices regarding the number of dimensions is compounded by disputes about the choice of reference axes to describe individual differences in location within the factor space even in cases where the number of dimensions required to describe personality is agreed upon (e.g., Gray, 1981). Given this confusion, formal personality theory and measurement models provide only general guidelines about which personality constructs to measure and about acceptable measurement procedures. This state of affairs makes it unwise to rely on theory as the only approach to personality-job outcome associations.

The second common approach to personality-job outcome associations develops an optimal predictor composite from a set of personality items by stepwise regression, stepwise discriminant function analysis, or related analysis procedures. All other things equal, these procedures select items which are uncorrelated within the sample and, therefore, are unlikely to identify any core of item content which would define the personality

constructs related to the criterion (Nunnally, 1978). Stepwise procedures also capitalize on chance item-criterion associations, so the resulting composites typically show substantial shrinkage in validity coefficients when applied to new samples. Thus, these procedures not only do little to help identify personality constructs related to job outcomes, but do not even satisfy the pragmatic objective of reliably predicting those outcomes.

Studying bivariate item-criterion (BIC) associations determined in multiple samples can minimize the problems outlined above. No assumptions about the dimensionality of personality space or the reference vectors appropriate to describe that space are required, because a priori decisions about how to combine items into predictor composites are not involved. Correlated items can be selected, because each item is considered independently, rather than determining the increment in prediction or discrimination achieved by adding it to an existing composite of items. The risk of incorporating items with chance associations to the criterion is minimal if replication across samples is used as a criterion for screening items prior to forming predictive composites.

The potential benefits of studying replicated BIC associations must be weighed against Nunnally's (1978) argument that this approach will produce factorially complex, uninterpretable composites. This criticism is likely to apply if the retained items are simply summed into a scale which then is interpreted as a unitary construct. However, item selection can be followed by procedures such as factor analysis to separate the items into empirically homogenous subsets which may be interpretable as personality constructs germane to the criterion. The production of factor homogenous item dimensions of this sort has been usefully applied in past personality research (Comrey, 1970).

The foregoing considerations lead to the conclusion that examination of BIC correlations should be, at a minimum, a useful adjunct to other approaches to studying personality-job outcome associations. BIC studies can provide a set of established empirical associations as a basis for defining or choosing between alternative theoretical formulations. The present study tested three specific hypotheses regarding the BIC approach:

Hypothesis 1: Replicable BIC associations exist.

Hypothesis 2: Items selected by the BIC approach will identify meaningful personality constructs.

Hypothesis 3: BIC composites will have stronger criterion correlations in a new sample than composites developed by other procedures.

The first hypothesis is particularly important as it asserts that the fundamental requirement for using the BIC approach is met. The other hypotheses assert that the approach produces interpretable, generalizable results which are a legitimate basis for developing or refining theory.

The three hypotheses were tested by attempting to identify personality correlates of attrition from military basic training. This job outcome criterion was chosen because personality and attrition are at least weakly related (Spielberger & Barker, 1979; Cook, Novaco & Sarason, 1980; Vickers & Conway, 1983). Stepwise discriminant function analysis and factor analysis provided comparison composites for evaluating the resulting personality predictors of attrition.

METHODS

Sample.

One study (hereafter, Study 1) involved 2,648 male Marine Corps recruits who volunteered to participate in a study of personality after receiving a full description of the research procedures which included completion of self-descriptions and a review of their basic training records. The present analyses were restricted to 2,451 recruits who graduated from basic training or were discharged prior to completing basic training because of behavioral or performance problems. These recruits averaged 18.9 (S.D. = 1.9) years of age. The major ethnic groups were Whites (70%), Blacks (16%), and Hispanics (8%). Most recruits had graduated from high school (64%), but many had a Graduate Equivalency Diploma (8%) or failed to complete high school (28%).

A second study (hereafter, Study 2) involved 345 male Marine Corps recruits who volunteered to participate in a similar study. Analyses involved 325 recruits who graduated from basic training or were discharged prior to completing basic training because of behavioral or performance

problems. These recruits averaged 19.1 (S.D. = 1.6) years of age. Ethnic composition was primarily White (82%) with a substantial number of Blacks (13%) and Hispanics (4%). Most of the recruits had graduated from high school (80%), but a substantial proportion had not (16%). Only a few recruits in this sample had a Graduate Equivalency Diploma (3%).

The Study 2 sample differed significantly from the Study 1 sample in two respects. The proportion of Whites was significantly higher (chi-square = 21.49, $p < .001$) as was the proportion of recruits with high school diplomas (chi-square = 34.44, $p < .001$). The age difference between the samples was not statistically significant ($t = 1.61$, $p > .10$, two-tailed).

Training Outcome Criterion.

The training outcome criterion was whether the recruit successfully completed basic training or was discharged from the service prior to completing basic training for behavioral reasons. The typical reasons for such discharges were fraudulent enlistment, poor performance, unsuitability, misconduct, or erroneous enlistment. Erroneous enlistments were grouped with other behavioral problems even though this type of discharge did not necessarily imply any behavioral deficiency during training. However, erroneous enlistment did imply a history of behavioral problems which might be related to personality (e.g., a juvenile record). This decision should not have a major effect on the results of the study, because erroneous enlistments were rare (n = 11). Recruits discharged for medical reasons were excluded from the analyses, because it was uncertain whether personality could reasonably be expected to play a part in these discharges. It was impossible to determine attrition status for 48 men, who necessarily were excluded from the analyses.

Personality Items and Scales.

The Study 1 employed 289 CPI items (Gough, 1960) used in coping and defense mechanism scales (Joffe & Naditch, 1977), the personality characteristics of interest when the studies were performed. The original item set was reduced to 168 items for Study 2 by deleting items on the basis of two criteria. First, items which appeared only in scales that were not related to performance, health, or mood in Study 1 (Vickers & Conway, 1983) were deleted. Second, items were deleted if they appeared in one or more

scales that correlated significantly with one of the three criteria, but were weakly related ($r < .05$) to the total scale score in all such scales.

Bivariate Item-Criterion (BIC) Composites. Risk ratios, defined as the probability of attrition given a "no" answer to an item divided by the probability of attrition given a "yes" answer, were computed for each item as follows:

$$\text{Risk Ratio} = (N_a/(N_a+N_g))/(Y_a/(Y_a+Y_g))$$

where N_a = the number of attrites responding "no" to the item, N_g = the number of graduates responding "no" to the item, Y_a = the number of attrites responding "yes" to the item, and Y_g = the number of graduates responding "yes" to the item.

The risk ratio was computed separately for each Study 1 subsample and for the Study 2 sample. A replicable BIC association was defined as a risk ratio greater than or equal to 1.25 in each subsample with a root mean square of the product of the ratios greater than or equal to 2.00 in Study 1. Risk ratios less than 1.00 were inverted for these determinations. The replication criterion was arbitrary but intended to identify items with a reliable direction of association to the criterion and sufficient diagnostic power to be of interest. Eighteen met the criterion, the same number selected in the stepwise discriminant function analysis described below. This fact simplified comparisons of the two procedures, but was fortuitous.

Stepwise Discriminant Function (SDF) Composites. Stepwise discriminant function analyses were conducted with the SPSS^X Discriminant program (SPSS, 1983) to produce item composites similar to those typical of stepwise procedures. This analysis divided the total item set in half, then developed separate discriminant functions for each half. The items entering the discriminant functions in these initial analyses were used in a third analysis to produce the final SDF composite. This multi-step procedure kept the computer resource requirements within the available limits. All analyses used $p < .05$ by Wilks' lambda as the inclusion criterion.

Factor Analytic (FA) Composites. Nichols and Schnell (1963) described two factors for the California Psychological Inventory. The first factor, labeled "Value Orientation", includes items concerning emotional stability, evenness of temperament, anger and hostility, anxiety, tension, physical health and well-being, denial of impulsivity, sense of duty, respect for

others, and respect for rules and social customs. The second factor, labeled "Person Orientation", includes items concerning being comfortable with others, enjoying interpersonal interaction, dominance, leadership, absence of embarassment, and quickness of response.

Reynolds and Nichols (1977) compared the predictive power of these two factors to that of the full set of standard scales from the inventory for a wide range of criteria. This comparison showed that the two factor analytic composites explained nearly as much variance as could be accounted for with the standard scales. It has been suggested that these scales represent neuroticism and extroversion, two widely-accepted dimensions of personality (Eysenck & Eysenck, 1985), so the two dimensions provide a parsimonious, theoretically-pertinent description of personality for criterion prediction. This framework, therefore, seemed a useful alternative to the other predictor composites being examined in this paper.

Replication Composites. Shorter versions of the predictor composites were employed in Study 2, because only a subset of the original items were administered in that study. Although each abbreviated scale correlated well to the longer scale ($r > .83$) in Study 1, the replicability of associations was estimated by relating the abbreviated scales to the criterion in both studies. This approach provided comparisons which would not be influenced by differences in scale content from one sample to the other.

RESULTS

Replicability of Risk Ratios.

The hypothesis that replicable BIC associations exist was tested by regarding each CPI item as a "case". Each case had three associated scores representing the risk ratios computed in the three random subsamples of Study 1. Items included in Study 2 had an additional score representing the risk ratio computed in that study. Pearson-product moment correlations were computed to describe the consistency of risk ratios across samples. These computations were performed for the risk ratios as originally computed and for the square-root transformations of those ratios. The transformation was introduced to reduce the skewness of the frequency distributions and to minimize any effects of extreme data points.

Table 1

Correlations of Item Risk Ratios Across Samples

	Study 1 Subsample: 1	2	3	Study 2
Study 1				
Subsample 1		.52	.55	.47
Subsample 2	.50		.58	.49
Subsample 3	.50	.54		.49
Study 2	.48	.48	.49	

NOTE: n = 289 for the correlations between the subsample risk ratios for Study 1; n = 168 for the correlations involving the Study 2 risk ratios. Correlations below the diagonal were computed with raw data; correlations above the diagonal were computed with square-root transformed risk ratios.

All of the correlations were substantial (Table 1) and statistically significant ($p < .001$). The arithmetic average of the three ratios for the subsamples in Study 1 correlated .57 with the risk ratios in Study 2 for both the raw and transformed ratios. The cube root of the product of the three Study 1 risk ratios correlated .58 with the ratios in Study 2 for both the raw and transformed ratios.

Relationships Among Items.

Principal factors analysis of the 18 BIC items meeting the replication criterion (see Method) tested the assertion that meaningful personality constructs would be identified by this selection procedure. The expectation that this approach would identify correlated items was evaluated by comparing the results to those from a similar analysis of the SDF items. The BIC items were more highly correlated, as indicated by a smaller determinant of the correlation matrix (.2254 versus .5906), larger value of Bartlett's chi-square test (3160.22 versus 1117.10), larger Kaiser Meyer-Olkin measure of sampling adequacy (.828 versus .637), greater proportion of off-diagonal correlations exceeding .09 (absolute) (9.2% versus 5.2%), and greater proportion of variance explained by the first two eigenvalues for the correlation matrix (25.2% versus 18.2%). Also, 20 interitem correlations

exceeded r = .20 (absolute) for the BIC items, while only 1 such correlation was obtained for the SDF items.

A scree-test suggested two or three factors would be appropriate to represent the intercorrelations between the BIC items, but only two were retained. This decision was based on evidence that direct application of simple eigenvalue tests tends to extract too many factors when analyzing dichotomous items (Collins, Cliff, McCormick & Zatkin, 1986). Factor pattern loadings for direct oblimin rotation (delta = 0) of the two factors are given in Table 2.

Table 2

Descriptive Statistics for BIC Items

	Risk Ratio:				Factor	
	Study 1 Subsample			Study 2	Loadings	
Item	1	2	3		1	2
Factor 1						
369	.49	.54	.47	.47	.53	.00
477	.58	.50	.42	.19	.49	.05
416	.55	.33	.48	.27	.49	.02
92	.60	.36	.51	.33	.47	-.10
422	.36	.59	.46	.40	.46	.21
337	.78	.39	.36	29	.39	.07
372	.76	.39	.39	.48	.35	.00
411	.50	.38	.46	.34	.33	.08
13	.54	.50	.43	.54	.27	.22
Factor 2						
224	1.67	1.75	3.44	4.30	.05	-.40
451	2.24	1.72	2.30	2.99	.03	-.40
54	.53	.48	.37	.27	.27	.30
311	.32	.35	.35		.20	.31
382	1.29	1.89	3.41		-.06	-.30
259	2.85	1.98	1.78		.11	-.29
312	1.86	1.64	4.72	1.82	.00	-.28
Other Items						
248	.37	.39	.34	.32	.19	.14
217	.41	.61	.46	1.43	.06	.02

Table 3

Item Content of Factors

Factor 1: Depressive Affect	
369	I seem to do things I regret more often than other people do.
477	I get tired more easily than other people seem to.
416	I don't think I'm quite as happy as others seem to be.
92	People often expect too much of me.
422	I feel like giving up quickly when things go wrong.
337	Much of the time my head seems to hurt all over.
372	I have reason for feeling jealous of one or more members of my family.
411	I am bothered by acid stomach several times a week.
13	I am very slow making up my mind.
Factor 2: Task Optimism	
224	I usually expect to succeed in things I do.
451	I set a high standard for myself and I feel others should do the same.
54*	I find it hard to keep my mind on a task or job.
311*	I cannot do anything well.
382	Success is a matter of will power.
259	I usually feel that life is worthwhile.
312	Any man who is able and willing to work hard has a good chance of succeeding.
Miscellaneous	
217	I think I would like the work of a librarian.
248	I must admit that I have a bad temper, once I get angry.

* Reverse scored items for the composites described in the text.

The item content for the two factors is given in Table 3 with factor labels assigned to suggest possible interpretations of the two factors. The first factor was labeled Depressive Affect, because items with substantial

loadings on this factor involved negative affect, somatic symptoms, and cognitive impairment. Each of these content areas represented established major categories of depressive symptoms (Beck, 1967; Levitt, Lubin & Brooks, 1983).

The second factor was labeled "Task Optimism", because items with high loadings on the second factor suggested striving for achievement with a firm belief that the efforts would be successful. This factor would be a reasonable component of the general personality dimension of conscientiousness or will-to-achieve (Digman & Takemoto-Chock, 1981; Costa & McCrae, 1985; Digman & Inouye, 1986).

The proposed interpretations are only suggestions, because the data pose at least three interpretive difficulties. First, not all items produced results consistent with the proposed interpretations. The inverse of item 259, the perception that life is worthwhile, is sometimes regarded as an indicator of depression, but was linked to goal-oriented optimism in this study. Similarly, item 422, feeling like giving up quickly, seems more logically related to poor goal striving than to depression. Second, additional interpretation uncertainties were posed by the fact that items 54 and 311, *dealing with problems concentrating* and low perceived personal competence, respectively, had substantial secondary loadings on the first factor. Finally, the two factors were correlated ($r = -.29$).

Given the preceding facts, two other potential interpretations of the factors merit consideration. One alternative interpretation would be that the two factors identify two distinct subcomponents of the general personality dimension of neuroticism, rather than representing distinct higher order dimensions of neuroticism and conscientiousness. A second alternative interpretation would be that increased risk of attrition occurs when low conscientiousness is combined with high neuroticism. Items representing this quadrant of the two-dimensional factor space defined by the dimensions of conscientiousness and neuroticism would be expected to have the factor structure just defined, provided the item pool included items which were more closely related to one general dimension than the other.

BIC composites for the analyses described in the remainder of this paper were formed by summing items with factor pattern loadings greater than .25 on a given factor. This inclusion criterion is lower than values typically used to define composites following factor analysis, but assigned 16 of 18 items

to one composite or the other. Given the sample size, the criterion substantially exceeded the magnitude required for statistical significance as estimated in simulation studies (Gorsuch, 1974, p. 185). An overall BIC composite was formed for comparison to the SDF composite by summing responses to all the items so that high scores would be associated with higher risk of attrition.

Prediction of Training Outcome.

The associations between the personality composites and the training outcome criterion can be summarized in terms of two general trends. First, the BIC approach was nearly as effective as SDF in predicting the criterion in Study 1 and was a better predictor in Study 2 (Table 4).[1] This statement applies whether the BIC items were summed to define an overall composite or the two factor composites were used to produce a multiple correlation coefficient. Second, the BIC approach was more effective than the FA scales in both samples. In fact, each BIC factor composite alone was a better criterion predictor in Study 2 than either the SDF composite or the combined FA scales.

The results also highlighted the tendency for SDF to capitalize on chance associations. Although the SDF composite was significantly related to the criterion in Study 2, it was the only composite which produced a weaker association in Study 2 than in Study 1.

[1]Further comparison of the BIC and SDF approaches was provided by creating composites based on each approach for each of the three subsamples in Study 1. The number of items selected for the BIC composite was fixed equal to that selected by the SDF procedure. The median cross-validation coefficient for the BIC composites was .142 compared to .040 for the SDF composites. All six BIC replication coefficients were significant beyond the 1% level, while only one SDF replication coefficient achieved this significance level. In fact, 4 of 6 SDF replications failed to achieve even the 5% significance level, despite the moderately large sample sizes involved.

Table 4

Associations Between Predictors and Attrition Status

	Study 1[a]:						Study 2		
	Full Scale			Abbreviated Scale					
Predictor	r	t	Sig.	r	t	Sig.	r	t	Sig.
BIC Total	.236	10.66	.001	.224	10.07	.001	.260	4.44	.001
Depressive Affect	.194	8.69	.001	.194	8.69	.001	.245	4.17	.001
Task Optimism	-.179	7.98	.001	-.146	6.48	.001	-.209	3.52	.001
Dep. Aff.+ Optimism[b]	.225		.001	.212		.001	.263		.001
Discriminant Function	.271	12.33	.001	.235	10.63	.001	.173	2.90	.002
Nichols-Schnell									
Person Or.	.128	5.66	.001	.124	5.49	.001	.129	2.14	.017
Value Or.	.068	2.98	.002	.067	2.96	.002	.177	2.97	.002
Person Or.+ Value Or.[b]	.132		.001	.128		.004	.198		.003

[a]The "Full Scale" in Study 1 was comprised of all the items for that scale as defined in the text. The "Abbreviated Scale" included only those items also available in Study 2 and, therefore, is the appropriate reference point for evaluating validity coefficient shrinkage. The differences in the item sets for the two studies are described in the Method section.

[b]Row entries indicate multiple correlation coefficients combining the indicated predictors.

DISCUSSION

The results justify the study of BIC associations as one means of identifying personality correlates of behavioral criteria, including job outcomes. As hypothesized, BIC associations differed reliably between items, even with a skewed criterion and even when computed in the relatively small Study 2 sample. The BIC approach is feasible only if reliable differences in item-criterion associations occur, so this finding established that a critical requirement for BIC applications was met.

The hypothesis that the BIC approach would identify meaningful personality constructs was confirmed by factor analysis of the 18 items with risk ratios greater than 1.25 in each of the three random subsamples of Study 1 and a cube root greater than 2.00 for the product of those three risk ratios. Two distinct personality attributes were defined which suggested that the unsuccessful recruit combines a predisposition toward depression with little or no optimism about ability to complete tasks successfully. In terms of current personality measurement models, these two factors could be specific facets of neuroticism, or the task optimism dimension could be a facet of conscientiousness. Another possibility is that the two factors only approximated the two established general dimensions of personality, because these aspects of personality interact to determine training success. In this case, the items which would best predict attrition would be ones that represented the combination of the two pertinent dimensions, rather than relatively pure indicators of either dimension alone. Any of these interpretations provides a potentially fruitful starting point for further study of personality and attrition from military basic training.

The conclusion that the second hypothesis was supported is subject to the caveat that substantively interpretable results from the factor analysis may have been virtually certain. Almost any factor analysis of personality-relevant items should be interpretable in terms of five general areas of behavior (Goldberg, 1981), and human ingenuity can produce plausible interpretations even for factor analyses of randomly generated data (Armstrong & Soelberg, 1968). For these reasons, the two BIC dimensions must be interpreted cautiously until additional study clarifies their scope and their relationship to established personality attributes. It is expected that further study will provide evidence of clear, simple links to

established personality constructs. The purpose in proposing the BIC approach was to investigate personality-job outcome associations with a minimum of assumptions, not to develop novel personality measures. The results seem adequate to illustrate the potential for the BIC approach to provide a useful empirical basis for further work. In this regard, it is important to emphasize that the primary value of the BIC approach is that it can provide a set of reliable empirical associations as the basis for developing or refining theory.

The final hypothesis tested in this study was that BIC composites would produce more robust correlations to the criterion than alternative procedures. The BIC was inferior to SDF in Study 1, as expected given that SDF develops an optimum predictive composite. It was more important that the BIC composite predicted the criterion better than the SDF composite when applied to a new sample. The BIC composite was superior to the FA composites in Study 2, but Reynolds and Nichols' (1977) finding that their two factors extracted most of the predictive variance from the item set was replicated. If a range of criteria were considered, the FA composites well might have greater general predictive validity than the BIC composites. Certainly Nichols and Schnell's (1963) FA composites merit consideration in future studies as a basis for broad scale prediction of behavioral criteria.

One surprising aspect of the findings was that the BIC and FA composites were better predictors of the criterion in Study 2 than in Study 1. The general trend may be explained by the higher educational level typical of Study 2 participants, if better education implies better quality data. Also, all of the participants in the replication study came from a single organizational unit. If differences between organizational units are related to attrition, this difference between Studies 1 and 2 would tend to inflate the apparent effect of personality (Golding, 1975). Finally, the use of a shorter personality inventory in Study 2 may have produced generally higher quality data by permitting respondents to attend more closely to the items. This trend did not extend to the SDF composite which showed the typical loss of predictive power when applied to a new sample, underscoring the tendency for this procedure to produce composites which capitalize on chance associations in their development sample.

Skeptics could argue that the foregoing considerations are only of intellectual interest, because the associations were weak (e.g., Mischel,

1968). However, the BIC personality measures had low measurement precision, as would be expected given their brevity and dichotomous response format. Also, the dichotomous criterion may be a crude index of a continuous dimension of competence for military service. Correcting for these limitations would be expected to lead to estimated associations much larger than those observed here. For example, if the criterion dichotomizes a continuous dimension of fitness for military service, estimated biserial correlations (cf., Wherry, 1984, pp. 45-48) between personality and the criterion actually would exceed 1.00, given the 7 per cent attrition rate. The implication is that the magnitude of the observed associations may seriously underestimate the impact of personality on ability to adapt and perform effectively in the military, but the truth of this speculation remains to be determined.

In summary, BIC associations provide a useful starting place for refining personality theory and measurement relative to job-related criteria. In the present case, the examination of these associations identifies two specific personality attributes for further study and raises the possibility of interactions between those attributes as important for the job outcome of interest. The evidence that reasonable estimates of these associations can be obtained in a single sample of modest size was particularly encouraging.

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Bivariate item-criterion (BIC) associations only infrequently are examined to identify personality correlates of job outcomes. However, examining these associations may reduce reliance on questionable assumptions embodied in more frequently used approaches to this problem. The present study provided evidence that personality items have reliably different strengths of association to attrition from military basic training. The study also showed that items with consistently strong BIC associations defined two interpretable factors which made reliable, independent contributions to the prediction of attrition. The associations of these BIC composites to the attrition criterion were more stable than that for a stepwise discriminant function composite and stronger than those produced by composites developed through factor analysis of the personality inventory. Overall, the BIC approach was an efficient method of identifying meaningful personality predictors for the job-relevant behavioral criterion.

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